PB 211 072

IMPORT SUPPLEMENT

to

OIL AVAILABILITY BY SULFUR LEVELS

by
Staff, U.S. Bureau of Mines

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Quantities of imports of heavy fuel oils by sulfur content, country of origin (source), U.S. port of entry, and quantity of elemental sulfur are the principal subjects. Legislative actions regulating the sulfur content of imported heavy fuel oils have been responsible for dramatic increases in low-sulfur (less than 1 percent) imports. During the 4-year period, January 1968 through December 1971, imports of residual and No. 4 fuel oils totaled 1.92 billion barrels, of which 653 million barrels (34 percent) was classified as low sulfur. An estimated 5.2 million tons of elemental sulfur was contained in these imports. Venezuela was the principal source (38 percent), and the Port of New York received a greater volume of imports than any other port. Trends evident in the last half of 1971 indicate that the demand for low-sulfur residual and No. 4 fuel oils exceeds the supply.

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Import Supplement

to

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Environmental Protection Agency

Office of Air Programs

June 1972

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ABSTRACT

This report, dealing with imports of heavy fuel oils, is a supplement to that published in August 1971 by the staff of the U.S. Bureau of Mines under the title "Oil Availability by Sulfur Levels". Quantities of imports by sulfur content, country of origin (source), U.S. port of entry, and quantity of elemental sulfur in the fuel oils are the principal subjects discussed.

Legislative actions regulating the sulfur content of imported heavy fuel oils have been responsible for dramatic increases in low-sulfur (less than 1 percent) imports. During the 4-year period, January 1968 through December 1971, imports of residual and No. 4 fuel oils totaled 1.92 billion barrels, of which 653 million barrels (34 percent) was classified as low sulfur. An estimated 5.2 million tons of elemental sulfur was contained in these imports. Venezuela was the principal source (38 percent), and the Port of New York received a greater volume of imports than any other port.

Trends evident in the last half of 1971 indicate that the demand for low-sulfur residual and No. 4 fuel oils exceeds the supply. Energy problems have arisen owing to inadequate supply, and expected new restrictions on sulfur content of fossil fuels will cause even greater shortages. Requirements to meet the anticipated demand for energy will include new desulfurization plants, low-sulfur crude oil substitutions for residual fuel oil, blending of heavy fuel oils, and use of low-sulfur coal (as fuel or source of synthetics).

Data incorporated in this study were generated by the Mines Energy Resources, Information, and Transportation System (MERIT System), as were those data used in the original study "Oil Availability by Sulfur Levels". The MERIT System is a computer based energy data bank encompassing both the petroleum and coal industries.

INTRODUCTION

This document, a supplement to an initial report on "Oil Availability by Sulfur Levels," presents data on imports of residual and No. fuel oils for the period January 1968 through December 1971. Also included are imports of distillate fuel oil for January 1970 through December 1971. Import data on these fuels were considered essential to acquiring an understanding of use distributions in the various areas and states, which were compiled as part of a contract between the Office of Air Programs, Environmental Protection Agency, and the Bureau of Mines.

The Bureau of Mines has established an energy data bank identified by the acronym MERITS (Mines Energy Resources, Information, and Transportation System) to fulfill an every increasing Federal need for accurate information on the mineral fuels. The data bank, currently comprised of more than three million computer card equivalents of basic data on the petroleum and coal industries, contains all import information used in this report. New import data are added to the system monthly.

Part of the data used for this study (years 1968 through part of 1971) were obtained from the Oil Import Administration, and subsequent data came from the Office of Oil and Gas. Data covering the years 1968 and 1969 were collected and keypunched by the Office of Air Programs, and then submitted to the Bureau of Mines. The data consisted of residual fuel oil imports by quantity and sulfur content. No. 4 fuel oil imports were not differentiated and are part of the total residual fuel oil reported for these 2 years. Additional information included importing company, country of origin, and U.S. port of entry.

The Bureau of Mines collected data for residual, No. 4, and distillate fuel oil from the Oil Import Administration and the Office of Oil and Gas for the period January 1970 through December 1971. Quantity of residual and No. 4 fuel oil with sulfur content and quantity of distillate fuel oil have been tabulated by various parameters as requested by the Office of Air Programs. These tabulations were designed to answer several important questions.

It was important to know the quantity and sulfur content of the fuel oils. Other parameters deemed necessary were country from which the fuel oil came (source), United States port through which it came, and the carrier or company that imported the fuel oil. Various combinations of these data were made and are included in the tables and illustrations. Analyses of such data in relation to legislature restrictions on sulfur content of fuel oils in the separate states were included in the study.

No attempt previously has been made to summarize fuel oil imports by the parameters set forth in this report. Results of the study show that of the 1.92 billion barrels of residual and No. 4 fuel oil imported into the United States during the 4 years studied, 34.1 percent contained less than 1 percent sulfur. Most of such fuel came into the Central Atlantic States, and legislative restrictions on sulfur content resulted in a definite increase in the quantity of low-sulfur fuel oil imported. The study pinpointed Venezuela as the main source for imported heavy fuel oil, New York City as the port receiving the largest quantity, and Hess Oil and Chemical Co. as the biggest importer of residual fuel oil.

ACKNOWLEDGMENTS

Appreciation is expressed to the Office of Air Programs for the 1968 and 1969 import data. Information for these 2 years formed a base for comparing periods before and after legislative sulfur restrictions were enacted in late 1969 and early 1970. Without such comparative capability, data interpretation would have been quite restricted.

HEAVY FUEL OIL IMPORTS

Heavy fuel oil imports, including No. 4 fuel oil, totaled 1.92 billion barrels for the period January 1968 through December 1971. During 1968 and 1969 the fuel oil imports included No. 4 fuel oil, but beginning January 1970 the two types of fuel oil were differentiated.

Imports of No. 4 fuel oil for 1970 and 1971 were 50.8 million barrels (table 1). Imports of residual fuel oil increased approximately 17 percent each year from 1968 to 1970, but 1971 imports increased only 4 percent over 1970.

The substantial annual increase has occurred primarily in imports of low-sulfur heavy oils. During 1971 the quantity of low-sulfur residual fuel oil was 276 million barrels, 51.5 percent of the total. Graphical representation of monthly residual fuel oil imports (fig. 1) clearly shows the seasonal trends of residual fuel oil imports as well as the increase in low-sulfur oil in 1970 and 1971. Relationships of low-sulfur residual fuel oil imports without seasonal influences, are evident in figure 2, which shows a steady percentage increase in the quantity of low-sulfur residual fuel oil imported from 7.7 percent in January 1968 to 50.6 percent in June 1971. A change in the rate of increase is apparent beginning in September 1969 (fig. 2); this resulted from legislation restricting the quantity of sulfur in heavy fuel oils.

Annual percentage distribution of the total No. 4 and residual fuel oils (fig. 3) indicates the increase in low-sulfur (less than 1 percent) imports. In 1968 only 15 percent of the imports was low sulfur, but by 1971 the percentage had increased to 51.5 percent. This demand for low sulfur imports was caused by State and municipal legislative actions.

TABLE 1. - Fuel oil imports by percent sulfur

(1,000 barrels)

Residual Fuel Oil

Year	Sulfur, percent					
	0-0.3	0.31-0.50	0.51-1.00	1.01-2.00	>2.00	Total
1968 1/	1,103	14,874	40,054	116,058	201,734	373,823
1969 1/	2,301	9,242	86,972	104,523	236,859	439,897
1970	11,324	33,331	144,321	78,940	247,788	515,704
1971	38,667	70,661	166,606	77,225	182,615	535,774
Total	53,395	128,108	437,953	376,746	868,996	1,865,198

1/ Includes No. 4 fuel oil. Total residual and No. 4 = 1,915,981.

No. 4 Fuel Oil

1970	490	2,175	10,617	4,314	8,806	26,402
1971	5,663	5,494	9,433	2,670	1,121	24,381
Total	6,153	7,669	20,050	6,984	9,927	50,783

Distillate Fuel Oil

1970	14,137	-	-	-	-	14,137
1971	17,564	-	-	-	-	17,564
Total	31,701	0	0	0	0	31,701

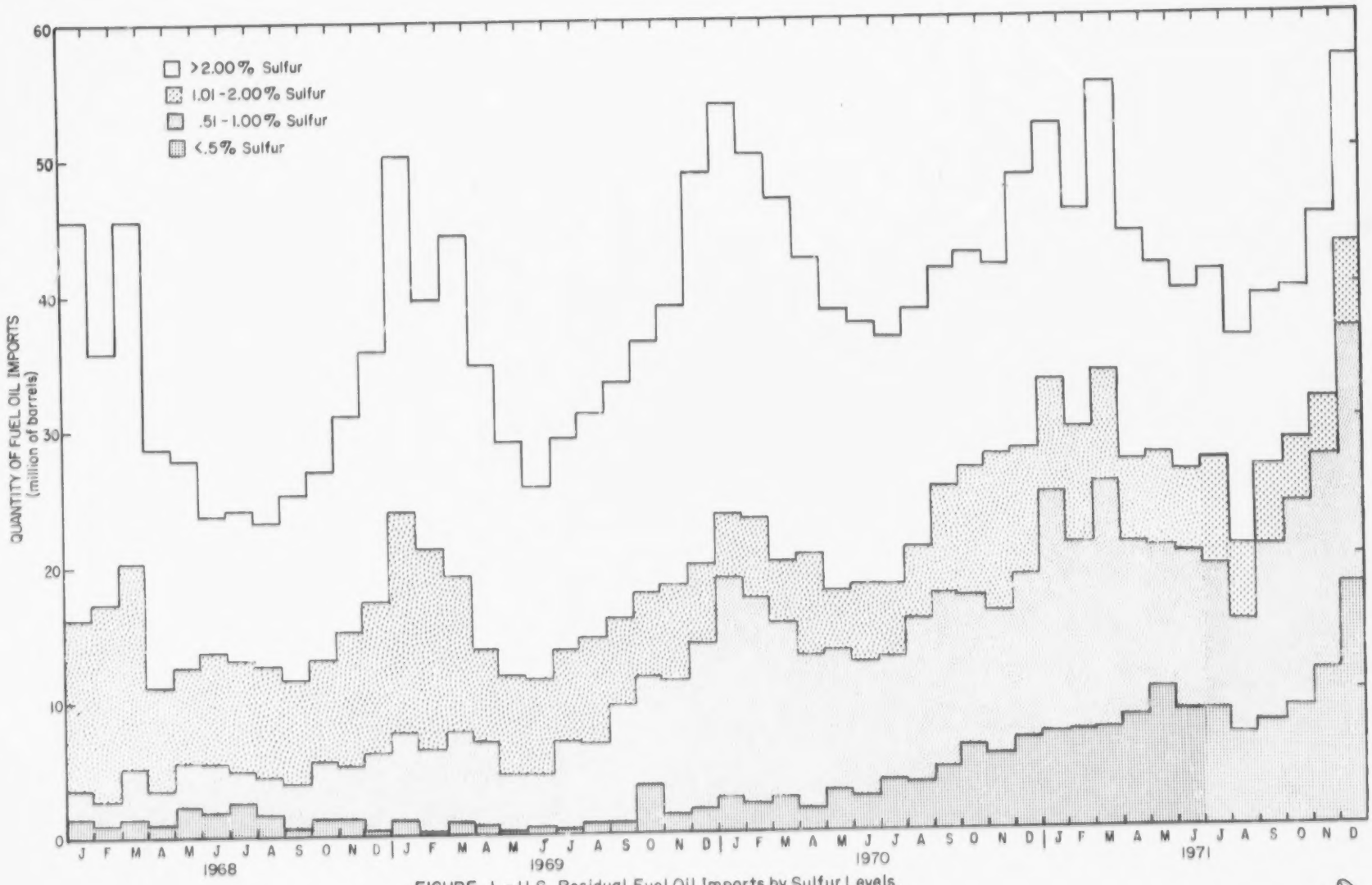
>2.00% Sulfur
1.01 - 2.00% Sulfur
.51 - 1.00% Sulfur
<.5% Sulfur
QUANTITY OF FUEL OIL IMPORTS
(million of barrels)
60
50
40
30
20
10
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1968
1969
1970
1971

FIGURE 1. - U.S. Residual Fuel Oil Imports by Sulfur Levels.

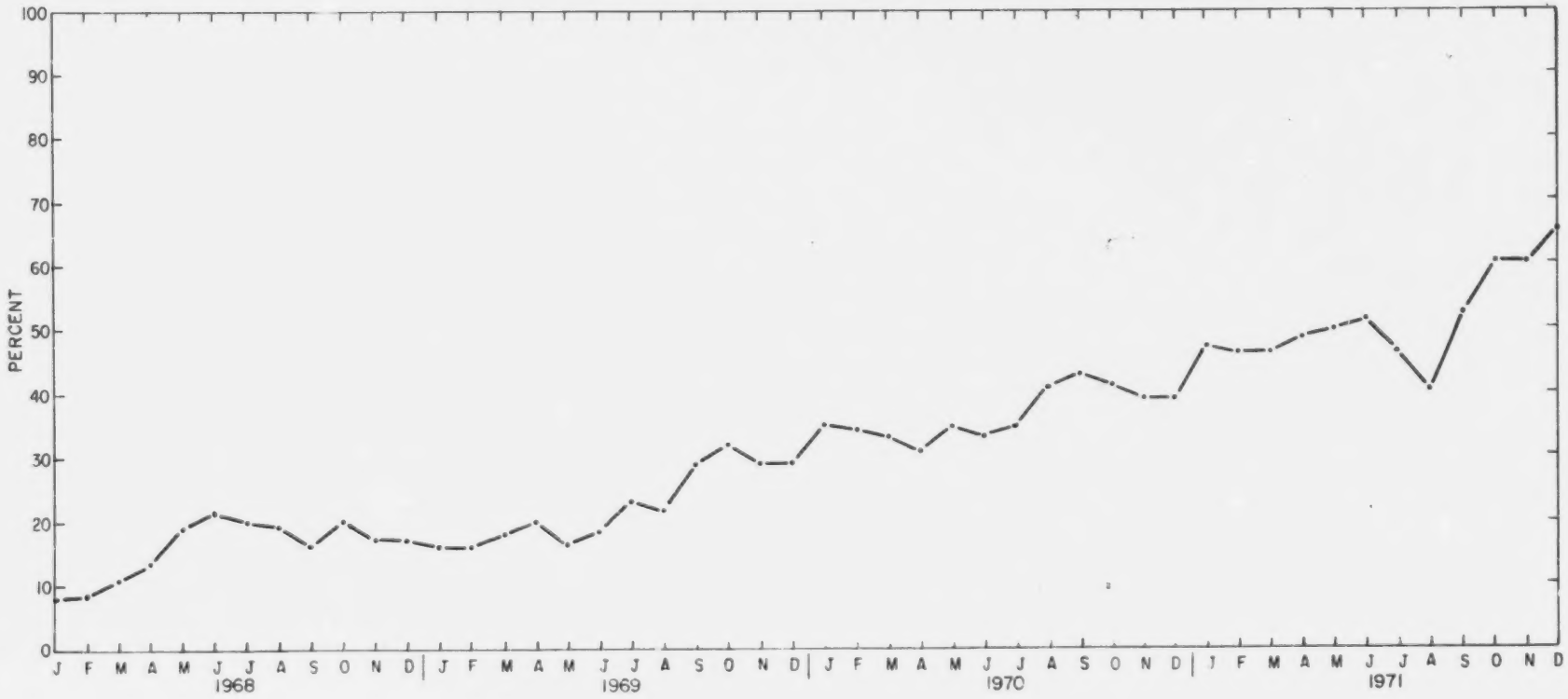

FIGURE 2.- Percent of Low Sulfur (<1.0%) Residual Fuel Oil.

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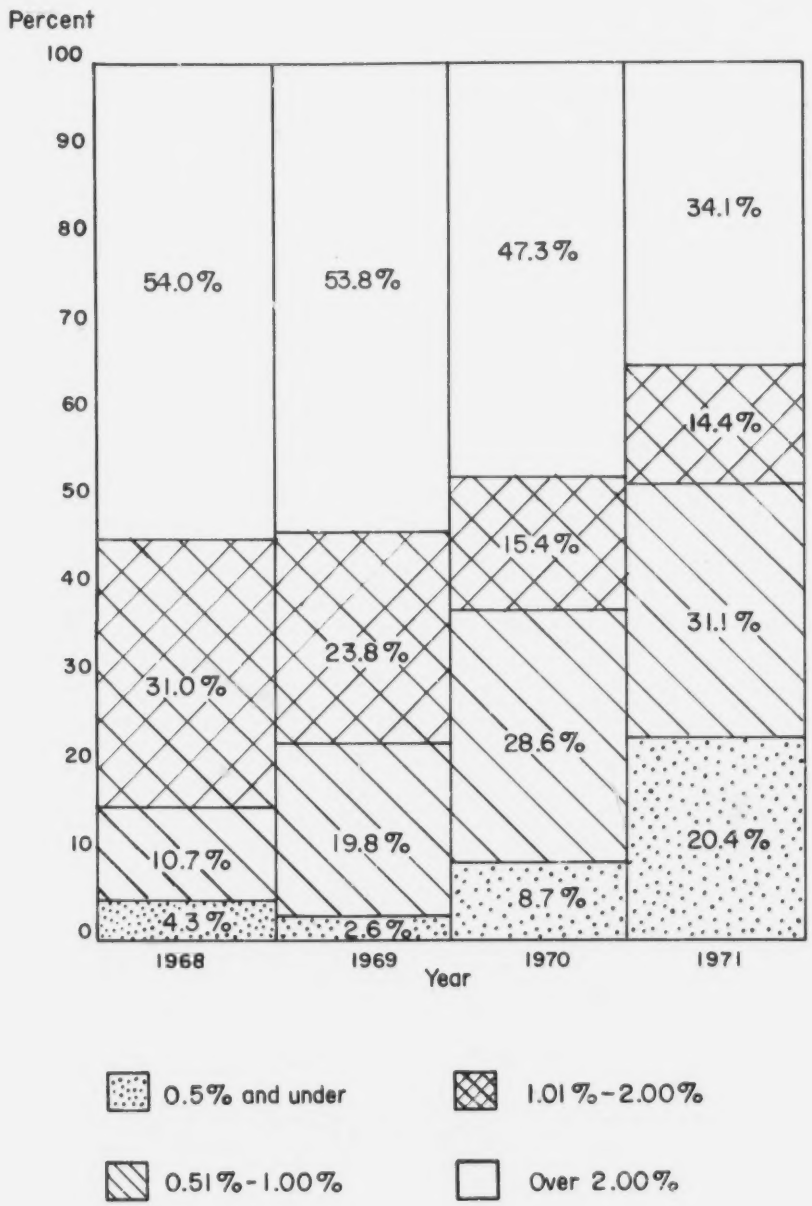

FIGURE 3.- Percent Distribution of No.4 and Residual Fuel Oil Imports by Sulfur Content 1968-1971.

Legislative control of sulfur content for heavy fuel oils has occurred primarily in the Central Atlantic States. Result of such legislative action is clearly evident in the increase of low-sulfur fuel oil imports. Seasonal trends also are obvious (fig. 4). Percentage of low-sulfur residual fuel oil imports (fig. 5) shows a dramatic increase from 12.2 percent in January 1968 to 80.6 percent in June 1970.

There have been no restrictions on imports of heavy fuel oil into East Coast ports since 1966; consequently, more than 99 percent of the total heavy fuel oil imports have entered this densely populated area. The East Coast area is divided into three segments, as follows (fig. 6):

New England States - Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and Vermont

Central Atlantic States - Eastern New York, New Jersey, Eastern Pennsylvania, Delaware, Maryland, and District of Columbia

Lower Atlantic States - Virginia, North Carolina, South Carolina, Georgia, and Florida

Heavy fuel oil imports into the Central Atlantic States totaled 1,090.3 million barrels or 57 percent of the total U.S. receipts from 1968 to 1971, whereas New England States received 460 million barrels (24 percent) and the Lower Atlantic States received 345 million barrels (18 percent).

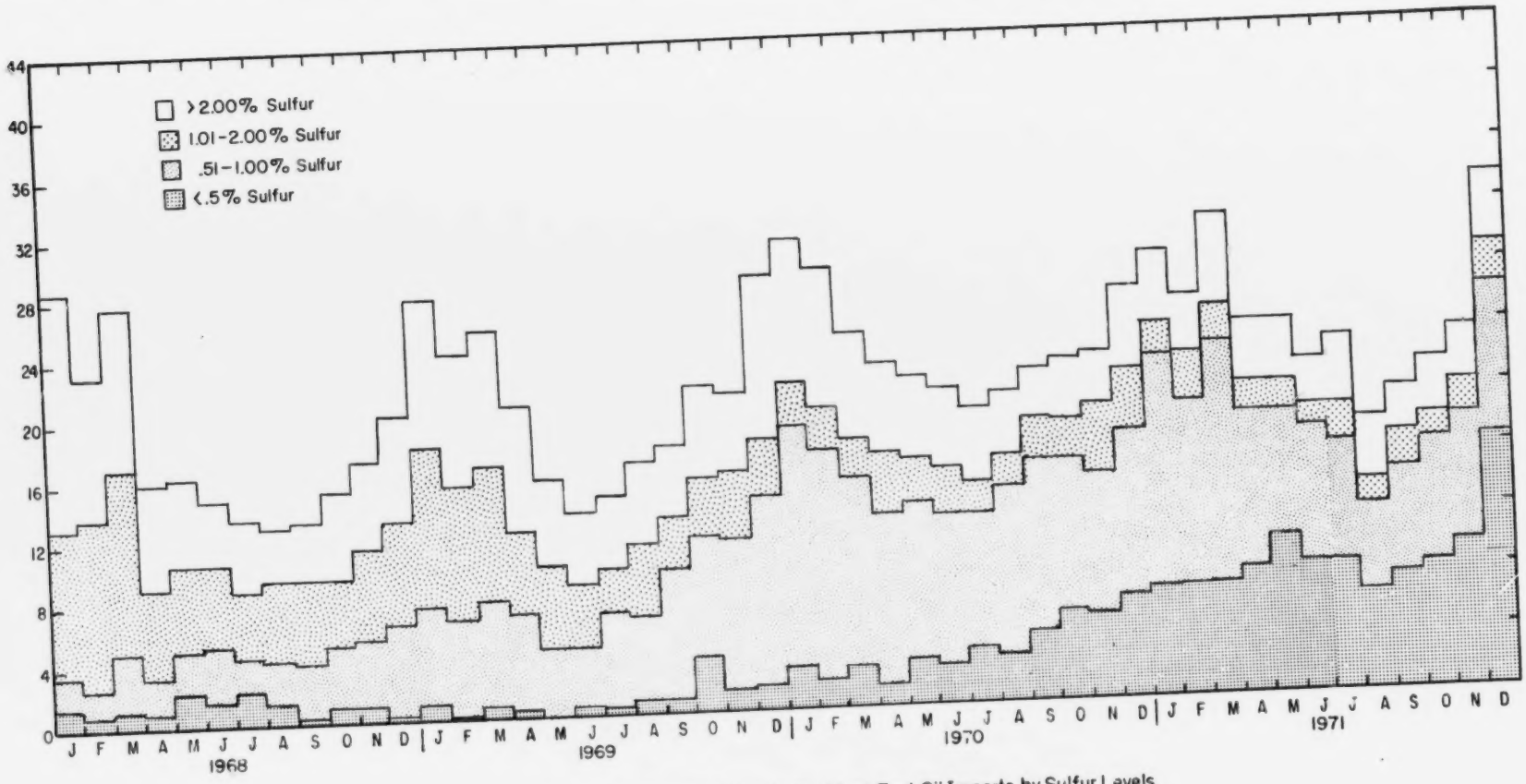

FIGURE 4.- Central Atlantic Residual Fuel Oil Imports by Sulfur Levels.

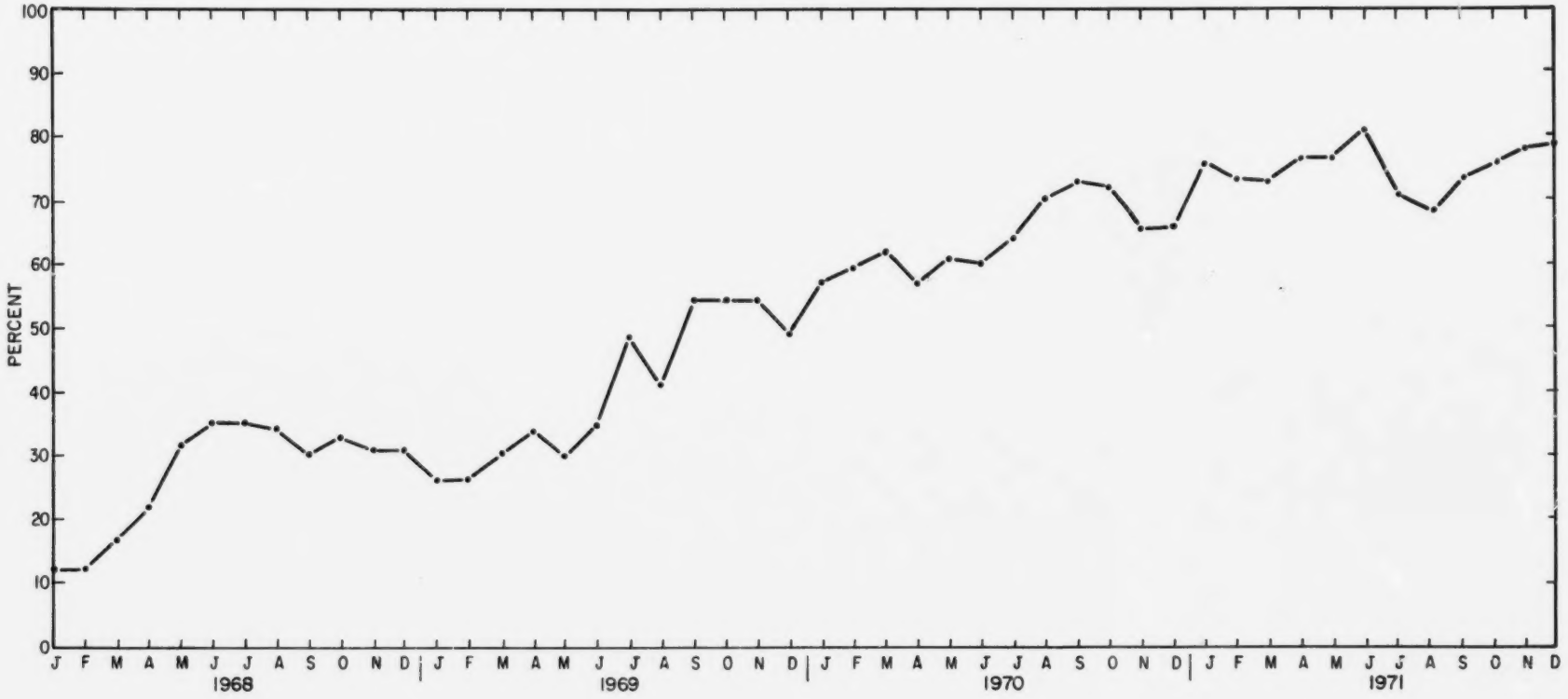

FIGURE 5.– Central Atlantic States, Percent of Low-Sulfur Imports.

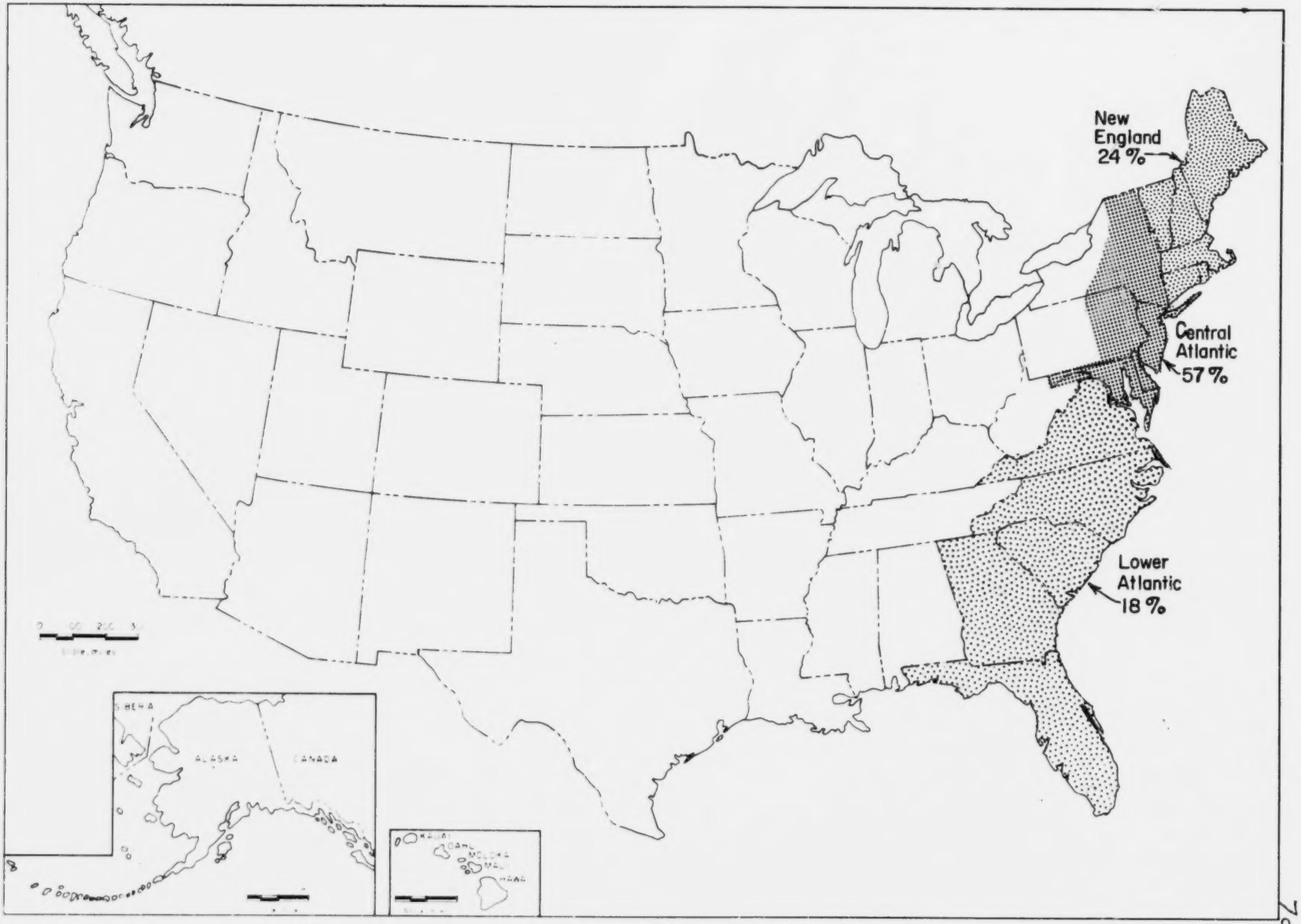

FIGURE 6.- East Coast Divisions.

Distillate fuel oil imports were 31.7 million barrels for the 2-year period January 1970 through December 1971. Normally, standards specify less than 0.3 percent sulfur in distillate fuel oils lighter than No. 4 oil; therefore, sulfur content data for these imports were not collected. The Central Atlantic area received 16.4 million barrels, 52 percent of the total, while the New England States received most of the remaining imports of distillate fuel oil.

Sources of Heavy Fuel Oil Imports

During the period January 1, 1968 through December 30, 1971, imports of No. 4 and residual fuel oils into the United States were received from some 30 foreign countries. Of the total 1.92 billion barrels imported, more than 80 percent came from the Caribbean area and Venezuela. The remainder was imported from European countries, plus small amounts from Canada, Mexico, and countries in Africa and the Middle East. On an individual basis (fig. 7), Venezuela was the main source for imported heavy fuel oil accounting for 38.0 percent of the total, followed by Netherlands West Indies (23.3 percent), Trinidad (11.7 percent), and Virgin Islands (8.5 percent).

Of the total imports of No. 4 and residual fuel oils during this 4-year period, 653.3 million barrels contained 1.0 percent or less sulfur. The amount of low-sulfur residual fuel oil supplied by each country was not proportionate to its total amount of residual fuel oil exported to the United States. Italy, which was the source for

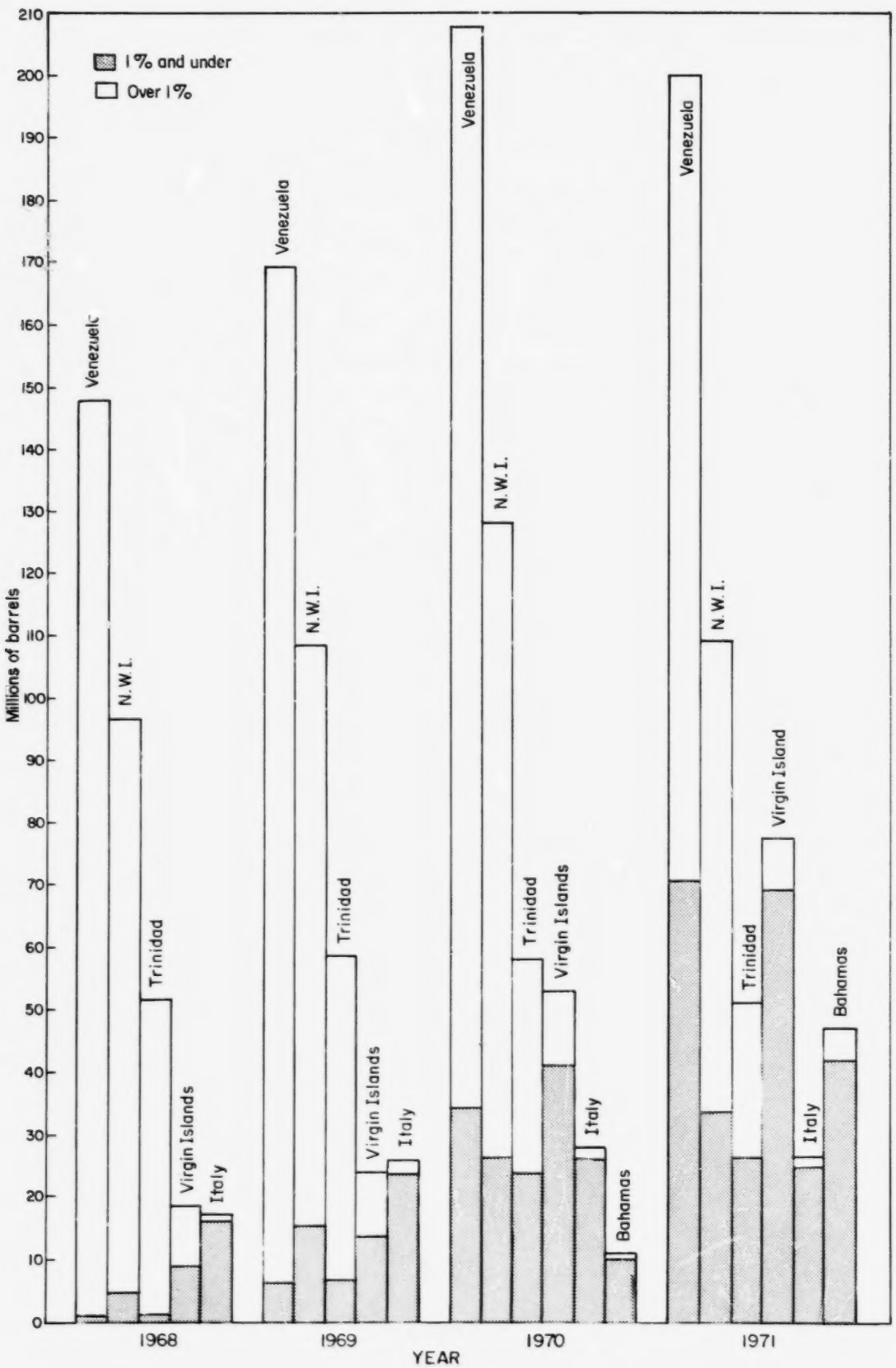

FIGURE 7.- Imports of No.4 and Residual Fuel Oils by Selected Countries of Origin.

only 5.1 percent of the total imports of residual fuel, supplied 14.7 percent of the total low-sulfur fuel oil imported into the United States. Other major suppliers (table 2) of low-sulfur residual fuel oil were the Virgin Islands (20.4 percent), Venezuela (17.1 percent), and Netherlands West Indies (12.4 percent).

Since the enactment of restrictions on the use of high-sulfur fuel oils by some States and local municipalities, the portion of all heavy fuel oil imports containing 1.0 percent or less sulfur increased during the 4 years beginning January 1, 1968. Most of this increase came from the Caribbean area where additional desulfurization capacity was added. In 1968 the Caribbean area supplied only 29.2 percent of low-sulfur heavy fuel oils; in the first 6 months of 1971, this area supplied 84.6 percent.

Heavy fuel oils are manufactured products from crude oil; therefore, designation of the origin of fuel oils is not necessarily indicative of the origin of the crude oil from which the fuel oils were made. In this report, fuel oil source refers only to the country from which the fuel oil came and no attempt has been made to determine crude oil sources. To fully understand the U.S. dependence upon foreign imports, it will be necessary to determine the source of crude oil from which the imports were manufactured. For example, during the 4-year period, about 15 percent of the low-sulfur heavy fuel oil came from Italy. The crude oil from which the fuel oil was manufactured, however, came from both domestic

TABLE 2. - Imports of No. 4 and residual fuel oils by selected countries of origin, 1968 to 1971

Country	Sulfur content				Total	
	1.0 percent and under		Over 1.0 percent			
	Quantity (1,000 bbls)	Percent	Quantity (1,000 bbls)	Percent	Quantity (1,000 bbls)	Percent
1968:						
Venezuela.....	760	1.4	146,935	46.2	147,695	39.5
N.W.I.....	4,859	8.7	91,741	28.9	96,600	25.8
Trinidad.....	1,584	2.8	49,511	15.6	51,095	13.7
Virgin Islands...	9,142	16.3	9,515	3.0	18,657	5.0
Italy.....	17,336	30.9	479	0.2	17,815	4.8
Others.....	22,350	39.9	19,612	6.1	41,962	11.2
Total.....	56,031	100.0	317,793	100.0	373,824	100.0
1969:						
Venezuela.....	5,647	5.7	163,930	48.0	169,577	38.5
N.W.I.....	15,289	15.5	92,892	27.2	108,181	24.6
Trinidad.....	6,965	7.1	51,921	15.2	58,886	13.4
Virgin Islands...	13,748	14.0	10,894	3.2	24,642	5.6
Italy.....	24,616	25.0	537	0.2	25,153	5.7
Others.....	32,250	32.7	21,209	6.2	53,459	12.2
Total.....	98,515	100.0	341,383	100.0	439,898	100.0
1970:						
Venezuela.....	34,666	17.2	173,440	51.0	208,106	38.4
N.W.I.....	26,717	13.2	101,004	29.7	127,721	23.5
Trinidad.....	23,524	11.6	34,943	10.3	58,467	10.8
Virgin Islands...	41,327	20.4	11,549	3.4	52,876	9.8
Italy.....	28,314	14.0	183	0.1	28,497	5.3
Bahamas.....	10,557	5.2	280	0.1	10,837	2.0
Others.....	37,153	18.4	18,448	5.4	55,601	10.2
Total.....	202,258	100.0	339,847	100.0	542,105	100.0
1971:						
Venezuela.....	70,413	23.8	130,423	49.5	200,836	35.9
N.W.I.....	33,903	11.4	75,425	28.6	109,328	19.5
Trinidad.....	26,244	8.9	23,868	9.0	50,112	8.9
Virgin Islands...	69,135	23.3	8,076	3.1	77,211	13.8
Italy.....	26,128	8.8	707	0.3	26,835	4.8
Bahamas.....	42,492	14.3	5,101	1.9	47,593	8.5
Others.....	28,209	9.5	20,031	7.6	48,241	8.6
Total.....	296,524	100.0	263,631	100.0	560,156	100.0

production, about 3 percent, and imports, 97 percent. Approximately 98 percent of the crude oil was produced in areas subject to embargo, blockade, or other curtailment during times of national emergency. In other words, 98 percent of Italy's crude oil imports came from Eastern Europe, Africa, and the Near and Middle East.

Another problem associated with heavy fuel oil imports involves desulfurization plants. The fuel oil desulfurized at a given plant may be derived from local refineries or it may come as an import from another country. In a national emergency, part or all of this fuel oil could be withheld from the United States depending upon the country from which the fuel oil originated before reaching the desulfurization plant. No attempt was made to determine the origin of the fuel oil prior to desulfurization.

Venezuela supplies the largest quantities of heavy fuel oil imported by the United States (table 3). During 1971, for example, Venezuela was the source of 54 percent of the distillate, 38 percent of the No. 4 fuel oil, and 36 percent of the residual fuel oil imports. Eight countries listed in table 3 supplied over 90 percent of the distillate, No. 4, and residual fuel oil imports in 1970 and 1971.

TABLE 3. - Origin of U.S. imports

(1,000 barrels)

Country	Distillate		No. 4 fuel oil		Residual fuel oil	
	1970	1971	1970	1971	1970	1971
Venezuela.....	6,444	9,422	13,699	9,336	194,407	191,499
Virgin Islands....	3,991	5,322	479	-	52,397	77,210
Canada.....	1,181	258	468	212	5,420	12,395
N.W.I.....	1,333	463	5,259	6,976	122,462	102,351
Trinidad.....	-	-	3,839	3,984	54,628	46,128
Netherlands.....	121	-	253	-	15,575	6,667
Italy.....	-	415	1,002	1,390	27,495	25,446
Bahamas.....	233	742	-	175	10,837	47,419
Total.....	13,303	16,622	24,999	22,073	483,221	509,115
Other countries...	1,205	942	1,402	2,308	32,483	26,660
Grand total.....	14,508	17,564	26,401	24,381	515,704	535,775
Percentage.....	91.7%	94.6%	95.7%	90.5%	93.7%	95.0%

Ports of Entry

Imports of heavy fuel oils arrive in the United States at ports having facilities for unloading oil from tankers and capable of storing the oils until distributed to various dealers. There are approximately 60 such ports in the United States, and in 1971 an average of 1.6 million barrels per day of heavy fuel oil entered through these ports.

In 4 recent years, 1968 through 1971, the East Coast received virtually all of the 1.92 billion barrels of heavy fuel oil imports, and 57 percent of it entered through ports in the Central Atlantic States (fig. 6). Other ports receiving heavy fuel oils are tabulated in tables 4 (distillate), 5 (No. 4), and 6 (residual). Sulfur content of fuel oils is also categorized in tables 5 and 6. The principal port of entry is New York City, which in 1971 received about 26 percent of the Nation's residual fuel oil, 58 percent of the No. 4 fuel oil, and 35 percent of the distillate.

In general, fuel oil is consumed in the vicinity of the port at which it enters the United States. Accordingly, very little additional cost is attributable to transportation from the port of entry to the point of consumption. The price of heavy fuel oil has increased largely in response to rising deamand and to the increased crude oil prices imposed by foreign nations.

TABLE 4. - Imports of distillate by port of entry

(1,000 barrels)

Port of Entry	1970	1971
Bridgeport	-	52
New Haven	671	1,847
Groton	48	320
Port Everglades	103	86
Miami	37	83
Jacksonville	10	167
Portland, Maine	154	155
Belfast	159	-
Baltimore	562	775
Salem	461	371
Boston	2,449	1,637
Port Huron	1,181	258
Portsmouth, N.H.	-	360
Portsmouth, Va.	229	-
Jersey City	78	3
Perth Amboy	693	1,167
Albany	484	222
Brooklyn	-	11
New York City	4,799	6,142
Port Jefferson	93	817
Wilmington, N.C.	-	258
Philadelphia	636	772
Newport	209	1,139
Providence	782	330
Charleston	238	501
Vancouver	-	91
Portsmouth	91	-
Mobile	169	-
Newington	60	-
Buckspot	112	-
Grand total	14,508	17,564

TABLE 5-IMPORTS OF NUMBER 4 FUEL OIL BY PORT OF ENTRY AND SULFUR LEVEL IN 1970
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
BRIDGEPORT	0.	0.	0.	179.	248.	427.
NEW HAVEN	0.	0.	0.	1058.	0.	1058.
WILMINGTON, DEL.	0.	0.	20.	0.	0.	20.
PORT EVERGLADES	0.	0.	100.	0.	0.	100.
JACKSONVILLE	0.	0.	254.	0.	0.	254.
SAVANNAH	0.	0.	0.	53.	236.	289.
BALTIMORE	0.	0.	262.	158.	719.	1139.
NEW BEDFORD	0.	0.	0.	0.	118.	118.
BOSTON	0.	0.	160.	33.	0.	193.
PORTSMOUTH, N.H.	0.	0.	53.	0.	0.	53.
NEWARK	0.	51.	697.	66.	0.	815.
JERSEY CITY	0.	0.	187.	0.	0.	187.
PERTH AMBOY	0.	0.	74.	0.	0.	74.
ALBANY	39.	206.	0.	238.	165.	648.
BUFFALO	0.	0.	0.	32.	0.	32.
NEW YORK CITY	423.	1704.	7352.	2444.	6529.	18451.
MASSENA	0.	0.	0.	17.	0.	17.
CHESTER	0.	0.	0.	0.	250.	250.
PHILADELPHIA	27.	201.	1142.	35.	158.	1563.
PROVIDENCE	0.	12.	316.	0.	0.	329.
NORFOLK	0.	0.	0.	0.	382.	382.
GRAND TOTAL	490.	2175.	10617.	4314.	8806.	26401.

TABLE 5-IMPORTS OF NUMBER 4 FUEL OIL BY PORT OF ENTRY AND SULFUR LEVEL IN 1971
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
BRIDGEPORT	0.	0.	94.	158.	0.	252.
NEW HAVEN	0.	0.	320.	606.	0.	926.
WILMINGTON, DEL.	0.	0.	128.	0.	0.	128.
PORT EVERGLADES	0.	0.	146.	0.	0.	146.
JACKSONVILLE	0.	0.	132.	0.	0.	132.
SAVANNAH	0.	0.	0.	13.	789.	802.
PORTLAND, MAINE	55.	0.	0.	0.	0.	55.
BALTIMORE	56.	0.	466.	0.	0.	522.
NEW BEDFORD	0.	150.	415.	0.	0.	565.
BOSTON	129.	0.	731.	0.	0.	860.
GLOUCESTER CITY	107.	114.	257.	0.	0.	479.
NEWARK	267.	212.	86.	0.	0.	565.
PAULSBORO	438.	0.	0.	0.	0.	438.
JERSEY CITY	84.	0.	374.	0.	0.	458.
PERTH AMBOY	0.	138.	39.	0.	0.	177.
ALBANY	133.	140.	90.	417.	0.	781.
BRONX	8.	161.	101.	0.	0.	269.
BUFFALO	0.	0.	0.	63.	0.	63.
BROOKLYN	0.	0.	324.	0.	0.	324.
NEW YORK CITY	3975.	4023.	5008.	1001.	67.	14074.
MOREHEAD CITY	0.	0.	0.	0.	20.	20.
CHESTER	0.	0.	0.	0.	245.	245.
PHILADELPHIA	410.	557.	569.	2.	0.	1537.
PROVIDENCE	0.	0.	155.	0.	0.	155.
NORFOLK	0.	0.	0.	409.	0.	409.
GRAND TOTAL	5663.	5494.	9433.	2670.	1121.	24381.

TABLE 6-IMPORTS OF RESIDUAL FUEL OIL BY PORT OF ENTRY AND SULFUR LEVEL IN 1968
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
SAN DIEGO	0.	0.	0.	5.	0.	5.
BRIDGEPORT	0.	0.	0.	1343.	2324.	3667.
NEW HAVEN	0.	0.	0.	1399.	12627.	14025.
GROTON	0.	0.	110.	1726.	1861.	3697.
WILMINGTON, DEL.	0.	0.	0.	44.	212.	256.
PORT CANAVERAL	0.	0.	0.	807.	0.	807.
PORT EVERGLADES	0.	0.	601.	20.	7163.	7784.
MIAMI	0.	0.	0.	0.	846.	846.
JACKSONVILLE	0.	0.	0.	3791.	6187.	9978.
PORT ST. JOE	0.	0.	0.	479.	0.	479.
TAMPA	0.	0.	0.	1471.	8234.	9705.
KEY WEST	0.	0.	0.	13.	5.	17.
WEST PALM BEACH	0.	0.	0.	0.	3508.	3508.
ST. PETERSBURG	0.	0.	0.	0.	5225.	5225.
SAVANNAH	0.	0.	0.	369.	2601.	2970.
HONOLULU	0.	0.	0.	0.	742.	742.
PORTLAND, MAINE	0.	0.	0.	1879.	4793.	6672.
WISCASSET	0.	0.	0.	445.	312.	757.
BANGOR	0.	0.	0.	119.	711.	831.
SEARSPORT	0.	0.	0.	904.	4878.	5782.
PINEY POINT	0.	0.	0.	4160.	0.	4160.
BALTIMORE	276.	849.	1408.	6192.	10571.	19296.
NEW BEDFORD	0.	0.	0.	1482.	3721.	5203.
SALEM	0.	0.	0.	1098.	2052.	3149.
BOSTON	0.	0.	619.	10874.	26275.	37768.
DETROIT	24.	0.	0.	21.	0.	45.
PORTSMOUTH, N.H.	0.	0.	0.	1287.	2404.	3691.
NEWARK	0.	0.	60.	838.	561.	1459.
PAULSBORO	0.	0.	131.	1847.	1229.	3207.
JERSEY CITY	0.	0.	217.	1338.	318.	1872.
PERTH AMBOY	139.	4677.	9355.	5277.	5537.	24984.
ALBANY	0.	0.	0.	1816.	4608.	6424.
NIAGARA FALLS	0.	0.	0.	167.	0.	167.
RENSSELAER	0.	0.	0.	35.	118.	153.
NEW YORK CITY	276.	8344.	26064.	40062.	47831.	122577.

TABLE 6 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
MASSENA	0.	0.	0.	28.	591.	619.
MOREHEAD CITY	0.	0.	0.	56.	250.	306.
WILMINGTON, N.C.	0.	36.	0.	178.	2744.	2957.
CHESTER	142.	0.	0.	259.	2006.	2407.
ERIE	0.	0.	0.	19.	0.	19.
PHILADELPHIA	246.	880.	1464.	18129.	9680.	30399.
NEWPORT	0.	0.	0.	242.	23.	265.
PROVIDENCE	0.	0.	24.	2988.	6459.	9471.
CHARLESTON	0.	0.	0.	973.	4437.	5410.
GEORGETOWN	0.	88.	0.	48.	1739.	1875.
NORFOLK	0.	0.	0.	1833.	6353.	8186.
GRAND TOTAL	1103.	14874.	40054.	116058.	201734.	373824.

TABLE 6-IMPORTS OF RESIDUAL FUEL OIL BY PORT OF ENTRY AND SULFUR LEVEL IN 1969
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
LOS ANGELES	0.	0.	0.	8.	0.	8.
BRIDGEPORT	0.	0.	0.	583.	6681.	7264.
NEW HAVEN	0.	0.	0.	766.	10232.	10998.
GROTON	0.	0.	201.	3333.	6719.	10253.
WILMINGTON, DEL.	0.	0.	108.	578.	1794.	2480.
PORT CANAVERAL	0.	0.	0.	1042.	0.	1042.
PORT EVERGLADES	0.	0.	160.	1005.	6026.	7191.
MIAMI	0.	0.	0.	63.	490.	553.
JACKSONVILLE	0.	0.	25.	8762.	5888.	14675.
PORT ST. JOE	0.	0.	0.	757.	206.	963.
TAMPA	0.	0.	0.	2103.	10116.	12219.
KEY WEST	0.	0.	0.	46.	6.	52.
WEST PALM BEACH	0.	0.	0.	0.	2841.	2841.
ST. PETERSBURG	0.	0.	0.	125.	6170.	6294.
SAVANNAH	0.	0.	4.	514.	3393.	3911.
HONOLULU	0.	0.	0.	0.	693.	693.
PORTLAND, MAINE	0.	0.	0.	663.	4910.	5574.
WISCASSET	0.	0.	0.	373.	269.	642.
BANGOR	0.	0.	0.	0.	1102.	1102.
SEARSPORT	0.	0.	0.	115.	5746.	5861.
PINEY POINT	0.	0.	2566.	1752.	0.	4318.
BALTIMORE	0.	1.	3335.	7346.	11567.	22249.
NEW BEDFORD	0.	0.	0.	915.	5152.	6067.
SALEM	0.	0.	30.	1102.	1907.	3038.
BOSTON	23.	0.	0.	9330.	34476.	43828.
DETROIT	0.	0.	21.	72.	0.	93.
PORTSMOUTH, N.H.	0.	0.	0.	137.	3713.	3850.
GLOUCESTER CITY	0.	0.	0.	308.	0.	308.
NEWARK	0.	0.	696.	199.	100.	995.
PAULSBORO	0.	0.	0.	622.	940.	1562.
JERSEY CITY	125.	360.	272.	806.	2113.	3676.
PERTH AMBOY	143.	1401.	16866.	3086.	1984.	23479.
PATTERSON	0.	0.	0.	0.	128.	128.
ALBANY	0.	0.	170.	2891.	5256.	8318.
BUFFALO	0.	0.	287.	0.	0.	287.

TABLE 6 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
NIAGARA FALLS	0.	0.	0.	207.	0.	207.
RENSSELAER	0.	0.	0.	0.	152.	152.
NEW YORK CITY	2011.	6719.	56328.	27777.	37218.	130053.
MASSENA	0.	0.	0.	33.	1838.	1872.
MOREHEAD CITY	0.	0.	0.	70.	410.	480.
WILMINGTON, N.C.	0.	0.	0.	644.	3280.	3924.
CLEVELAND	0.	0.	0.	0.	37.	37.
PORTLAND, OREGON	0.	0.	0.	0.	1119.	1119.
CHESTER	0.	129.	622.	0.	3278.	4029.
ERIE	0.	0.	0.	0.	36.	36.
PHILADELPHIA	0.	632.	5227.	18930.	18636.	43425.
NEWPORT	0.	0.	0.	288.	0.	288.
PROVIDENCE	0.	0.	55.	2225.	8522.	10802.
CHARLESTON	0.	0.	0.	1464.	4908.	6372.
GEORGETOWN	0.	0.	0.	422.	1859.	2281.
NORFOLK	0.	0.	0.	3059.	14949.	18008.
GRAND TOTAL	2301.	9242.	86972.	104523.	236859.	439898.

TABLE 6-IMPORTS OF RESIDUAL FUEL OIL BY PORT OF ENTRY AND SULFUR LEVEL IN 1970
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
MOBILE	3.	0.	0.	0.	0.	3.
LOS ANGELES	0.	0.	0.	33.	0.	33.
SAN DIEGO	0.	0.	0.	0.	1.	1.
BRIDGEPORT	0.	0.	0.	1162.	9007.	10169.
NEW HAVEN	0.	0.	0.	564.	15424.	15988.
GROTON	0.	0.	239.	3315.	7465.	11020.
WILMINGTON, DEL.	0.	0.	0.	284.	376.	660.
PORT CANAVERAL	0.	0.	0.	1253.	0.	1253.
PORT EVERGLADES	0.	0.	2055.	1760.	4561.	8375.
MIAMI	0.	0.	0.	0.	378.	378.
JACKSONVILLE	30.	368.	2082.	4561.	6083.	13125.
PENSACOLA	0.	0.	0.	2.	0.	2.
PORT ST. JOE	0.	0.	0.	389.	1251.	1640.
TAMPA	0.	0.	0.	4901.	9602.	14503.
BOCA GRANDE	0.	0.	0.	1990.	493.	2483.
KEY WEST	0.	0.	0.	30.	12.	42.
WEST PALM BEACH	0.	0.	0.	0.	3066.	3066.
ST. PETERSBURG	0.	0.	0.	625.	5614.	6239.
SAVANNAH	0.	0.	0.	909.	3760.	4669.
HONOLULU	0.	0.	0.	0.	730.	730.
CHICAGO	0.	121.	308.	0.	0.	429.
PORTLAND, MAINE	0.	111.	0.	1071.	6114.	7295.
BUCKSPORT	0.	0.	0.	0.	73.	73.
WISCASSET	0.	0.	0.	0.	97.	97.
BANGOR	0.	0.	64.	0.	688.	752.
SEARSPORT	0.	0.	161.	405.	4687.	5253.
PINEY POINT	0.	0.	5862.	2121.	639.	8622.
BALTIMORE	249.	361.	8728.	5570.	10360.	25268.
SANDWICH	0.	0.	120.	0.	4008.	4128.
NEW BEDFORD	84.	0.	0.	1490.	6421.	7995.
SALEM	0.	0.	0.	1031.	1219.	2250.
EVERETT	0.	0.	245.	0.	1467.	1711.
BOSTON	0.	0.	1249.	10343.	32248.	43840.
SAULT SAINT MARIE	0.	0.	0.	30.	0.	30.
DETROIT	373.	0.	752.	0.	339.	1463.

TABLE 6 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
NOYES	0.	0.	0.	0.	6.	6.
RANIER	0.	0.	0.	0.	2.	2.
PORTSMOUTH, N.H.	0.	0.	125.	1158.	3264.	4547.
GLOUCESTER CITY	0.	0.	0.	0.	204.	204.
NEWARK	50.	151.	336.	134.	[illegible].	721.
PAULSBORO	68.	0.	98.	38.	164.	369.
JERSEY CITY	149.	319.	1533.	229.	50.	2281.
PERTH AMBOY	69.	7155.	20276.	1127.	882.	29509.
ALBANY	0.	85.	662.	3937.	4338.	9022.
BRONX	0.	0.	193.	0.	0.	193.
BUFFALO	0.	0.	105.	366.	359.	830.
BROOKLYN	0.	0.	1646.	0.	0.	1646.
NIAGARA FALLS	0.	0.	0.	28.	0.	28.
NEWBURGH	0.	0.	0.	0.	319.	319.
OSWEGO	0.	0.	0.	0.	956.	956.
QUEENS	0.	124.	0.	0.	0.	124.
RENSSELAER	0.	0.	0.	0.	192.	192.
NEW YORK CITY	6033.	21075.	73374.	10837.	29597.	140915.
MASSENA	0.	0.	0.	57.	618.	675.
MOREHEAD CITY	0.	0.	0.	77.	674.	751.
WILMINGTON, N.C.	0.	0.	0.	84.	5834.	5918.
CLEVELAND	0.	0.	84.	0.	65.	149.
PITTSBURGH	0.	0.	0.	0.	16.	16.
CHESTER	0.	0.	1096.	54.	3120.	4270.
ERIE	0.	0.	0.	0.	19.	19.
PHILADELPHIA	4159.	3463.	22687.	9207.	17324.	56841.
NEWPORT	0.	0.	48.	305.	220.	572.
PROVIDENCE	57.	0.	171.	3298.	7818.	11345.
CHARLESTON	0.	0.	0.	819.	7556.	8375.
GEORGETOWN	0.	0.	0.	86.	2493.	2579.
HOUSTON	0.	0.	0.	0.	1.	1.
PORT ARTHUR	0.	0.	0.	0.	4.	4.
NORFOLK	0.	0.	21.	2256.	20707.	22984.
PORTSMOUTH, VA.	0.	0.	0.	1005.	4755.	5760.
GRAND TOTAL	11324.	33331.	144321.	78940.	247788.	515704.

TABLE 6-IMPORTS OF RESIDUAL FUEL OIL BY PORT OF ENTRY AND SULFUR LEVEL IN 1971
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
LOS ANGELES	0.	0.	0.	32.	0.	32.
SAN DIEGO	0.	0.	0.	34.	0.	34.
BRIDGEPORT	0.	687.	590.	1513.	4456.	7245.
NEW HAVEN	49.	136.	5473.	894.	9048.	15600.
GROTON	0.	0.	4821.	1458.	3794.	10073.
WILMINGTON, DEL.	0.	29.	0.	315.	346.	690.
PORT CANAVERAL	0.	0.	0.	1317.	0.	1317.
PORT EVERGLADES	0.	0.	6633.	2310.	732.	9675.
MIAMI	0.	0.	0.	0.	235.	235.
JACKSONVILLE	0.	274.	5896.	2610.	8626.	17407.
PENSACOLA	0.	0.	0.	8.	0.	8.
PORT ST. JOE	0.	0.	0.	858.	491.	1349.
TAMPA	0.	0.	350.	6022.	17449.	23820.
BOCA GRANDE	0.	0.	0.	2822.	0.	2822.
PORT MANATEE	0.	0.	0.	0.	116.	116.
KEY WEST	0.	0.	0.	21.	0.	21.
WEST PALM BEACH	0.	0.	1362.	1327.	879.	3568.
SAVANNAH	0.	0.	0.	397.	5204.	5601.
HONOLULU	0.	0.	0.	246.	416.	663.
CHICAGO	0.	0.	3145.	0.	0.	3145.
PORTLAND, MAINE	0.	0.	0.	2080.	8805.	10885.
BUCKSPORT	0.	0.	0.	200.	748.	948.
WISCASSET	0.	0.	0.	8.	98.	106.
BANGOR	0.	0.	0.	203.	396.	599.
SEARSPORT	0.	0.	0.	210.	4222.	4432.
SPARROWS POINT	0.	0.	117.	7.	0.	124.
PINEY POINT	39.	0.	7017.	5561.	1026.	13644.
BALTIMORE	56.	259.	20413.	1114.	2539.	24381.
SANDWICH	0.	177.	1803.	1570.	1789.	5338.
NEW BEDFORD	0.	0.	2188.	1759.	4419.	8366.
SALEM	0.	31.	829.	1227.	1398.	3484.
EVERETT	0.	0.	745.	71.	837.	1652.
NORTH WEYMOUTH	0.	0.	277.	0.	0.	277.
BOSTON	275.	2810.	12240.	7133.	11215.	33672.
DETROIT	0.	0.	0.	62.	733.	795.

TABLE 6 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
NOYES	0.	0.	0.	0.	7.	7.
RANIER	0.	0.	0.	0.	5.	5.
PORTSMOUTH, N.H.	0.	0.	110.	3493.	2757.	6360.
GLOUCESTER CITY	157.	187.	2894.	0.	0.	3238.
NEWARK	483.	140.	0.	91.	243.	957.
PAULSBORO	293.	771.	0.	0.	196.	1260.
JERSEY CITY	250.	1552.	890.	275.	378.	3344.
PERTH AMBOY	5100.	18308.	2239.	1573.	602.	27822.
ALBANY	0.	404.	247.	4476.	9375.	14502.
BRONX	429.	0.	1058.	60.	202.	1749.
BUFFALO	0.	0.	0.	525.	0.	525.
BROOKLYN	682.	292.	3652.	144.	873.	5644.
NIAGARA FALLS	0.	0.	0.	25.	89.	115.
NEWBURGH	0.	0.	0.	87.	114.	201.
OSWEGO	0.	0.	0.	0.	981.	981.
QUEENS	0.	299.	216.	67.	0.	582.
NEW YORK CITY	27177.	31160.	52005.	7418.	23767.	141527.
TAPPAN	0.	86.	0.	0.	0.	86.
MASSENA	0.	0.	0.	58.	566.	624.
PORT JEFFERSON	0.	0.	307.	0.	0.	307.
MOREHEAD CITY	0.	0.	0.	57.	476.	533.
WILMINGTON, N.C.	0.	0.	0.	2293.	4602.	6895.
PITTSBURGH	0.	0.	0.	0.	200.	200.
CHESTER	0.	0.	873.	0.	1917.	2791.
PHILADELPHIA	3677.	13011.	26434.	4627.	4890.	52640.
NEWPORT	0.	0.	246.	564.	991.	1801.
PROVIDENCE	0.	50.	1522.	3004.	2842.	7417.
CHARLESTON	0.	0.	0.	1693.	5107.	6800.
GEORGETOWN	0.	0.	15.	486.	2228.	2729.
NORFOLK	0.	0.	0.	2372.	25291.	27664.
PORTSMOUTH, VA.	0.	0.	0.	424.	3901.	4325.
SEATTLE	0.	0.	0.	21.	0.	21.
GRAND TOTAL	38667.	70661.	166606.	77225.	182615.	535775.

According to the National Coal Policy Conference, Inc., imported residual fuel oil provides about 40 percent of all industrial energy for the East Coast as well as about 35 percent of all electric power capacity. Since 1966, when controls on finished product imports were lifted, industrial plants and electric utilities have switched from domestic coal to imported fuel oil at a tremendous rate. Originally, price was the prime reason for the change, but since late 1969 legislative requirements for low-sulfur fossil fuels have forced additional conversions from coal to oil.

SULFUR CONTENT OF HEAVY FUEL OILS

Currently, the principal objection to heavy fuel oils as a combustible energy source is the sulfur content, which forms pollutant sulfur compounds when burned. An attempt has been made to estimate the quantity of elemental sulfur contained in the imported heavy fuel oils. An estimated 5.2 million tons of elemental sulfur was in the 1,916 million barrels of heavy fuel oil imported between January 1, 1968 and December 31, 1971. The quantity of low-sulfur (less than 1 percent) heavy fuel oils imported has been increasing each year. In 1971 the estimated total sulfur was 1.3 million tons compared with 1.4 million tons in 1970; this sulfur reduction occurred during the same period that imports of heavy fuel oil increased by 28 million barrels.

If sulfur is objectional in heavy fuel oils, then the problem becomes total sulfur and not barrels imported. When reviewed in this context, table 7 clearly defines the problem areas. For example, in 1968 there was a total of 62,559 tons of sulfur contained in 56 million barrels of heavy fuel oil (the three low-sulfur categories), and in 1970 these same categories contained 214,596 tons in 189 million barrels. While the imports of low-sulfur oils increased dramatically, the greater than 1 percent categories increased fairly constantly until 1971 when imports of residual fuel oil containing over 2 percent sulfur was reduced by 26 percent. To reduce the total tons of sulfur in heavy fuel oils while increasing the imports of fuel oils will require continued reduction of the fuel oils that contain more than 2 percent sulfur. The key to the problem, of course, is determined by the availability of low-sulfur heavy fuel oils. Even with accelerated construction of foreign and domestic desulfurization plants, the supply of low-sulfur heavy fuel oils remains critical.

The 51 million barrels of No. 4 fuel oil imported during the 2-year period, January 1970 through December 1971, contained an estimated 79,525 tons of sulfur (table 8). Of this quantity, 50,547 tons (64 percent) was in the upper two categories. There was a drastic reduction of No. 4 fuel oil containing over 2 percent sulfur in 1971. In fact, only 43 percent of the sulfur was in the greater than 1 percent categories in 1971.

TABLE 7. - Estimated quantity of sulfur in imported residual fuel oil

(tons)

Year	Sulfur, percent					
	≤.30	.31-.50	.51-1.00	1.01-2.00	>2.00	Total
1968[1/]	476	10,263	51,820	300,300	782,980	1,145,839
1969[1/]	992	6,377	112,520	270,453	919,309	1,309,651
1970	4,883	22,998	186,715	204,257	961,727	1,380,581
1971.....	16,675	48,756	215,546	199,820	809,490	1,290,287
Grand total...	23,026	88,394	566,601	974,830	3,473,506	5,126,358

1/ Includes No. 4 fuel oil.

TABLE 8. - Estimated quantity of sulfur in imported No. 4 fuel oil

(tons)

Year	Sulfur, percent					
	≤.30	.31-.50	.51-1.00	1.01-2.00	>2.00	Total
1970.....	186	1,283	11,745	9,545	29,225	51,984
1971.....	2,088	3,241	10,435	5,907	5,870	27,541
Grand total....	2,274	4,524	22,180	15,452	35,095	79,525

Dealers supplying consumers from bulk terminal storage facilities commonly blend heavy fuel oils to obtain a product of specified sulfur content. With more stringent control of sulfur content in heavy fuel oils, a shortage of low-sulfur oils necessary for blending has developed. This condition will spread as other areas restrict sulfur levels. Again, the need for low-sulfur fuel oil is apparent. For example, to reduce the sulfur in 1,000 barrels of residual fuel oil from 2 percent by weight down to 1 percent, would require 2,000 barrels of oil containing 0.5 percent sulfur.

CONCLUSIONS

Imports of heavy fuel oils primarily into the East Coast have increased dramatically since restrictions were lifted in 1966. These imports have caused a shift of energy requirements and a further dependence upon foreign sources. Fuel oil has replaced coal as a source of energy in many electric power generation and industrial plants. Concurrently, domestic refinery manufacture of fuel oils has declined. Price was the main factor in increasing fuel oil imports, but now pollution regulations governing sulfur content loom as the prime reason for increasing fuel oil imports. With demand increasing for more low-sulfur fuel oil, availability becomes the most important problem, even above price.

Venezuela is the main single source of imports of heavy fuel oil, accounting for about 39 percent of the total each year. The problem with much of the Venezuelan fuel oil is the high percent of sulfur it contains. Owing mainly to installation of desulfurization facilities, the proportion of low-sulfur fuel oils to total imports from Venezuela has been increasing. However, more desulfurization plants are urgently needed in Venezuela. The countries of Venezuela, Netherlands West Indies, and Trinidad supply more than 60 percent of the United States imports of heavy fuel oils; their exports to us of low-sulfur oils have increased from 13 percent in 1968 to 42 percent in 1970. In 1971 these three countries contributed 44 percent of the low-sulfur fuel oils. Import data by country of origin are shown in Appendix A, including quantities by sulfur categories.

One important facet not determined in this study deals with the source of the crude oil from which the foreign refineries manufactured their products. For example, although 23.1 percent of the United States heavy fuel oil imports came from the Netherlands West Indies, no attempt has been made to determine the origin of the crude oil from which the residual fuel oils were manufactured. Figure 8 graphically illustrates the flow pattern from crude oil to fuel oil import, using the Netherlands West Indies (N.W.I.) as the example:

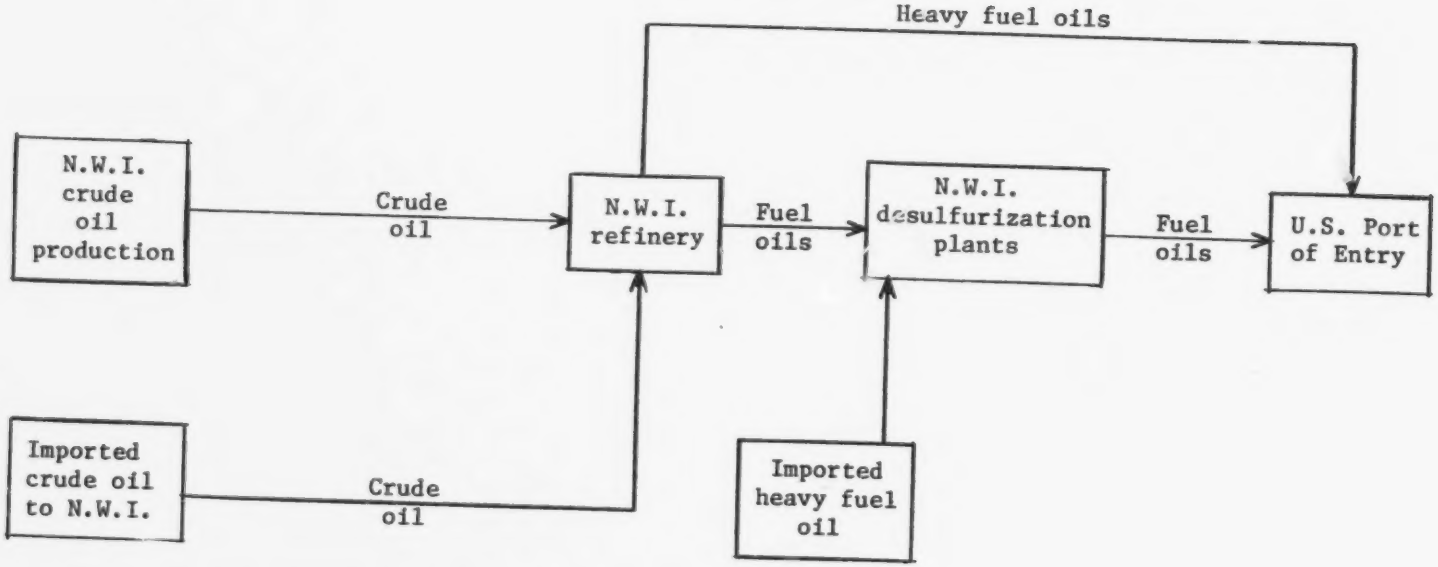

FIGURE 8. - Flow Pattern of Crude Oil to Imports.

Building on this base, future studies utilizing information in the MERIT System will provide further insight into the energy crisis. Specifically, the System should be used to provide data essential for proper analysis of the growing energy needs.

APPENDIX A.--Fuel Oils by Country of Origin

TABLE 9. - Imports of distillate by country of origin

(1,000 barrels)

Country of Origin	1970	1971
Canada	1,181	258
Panama	462	305
Bahamas	233	742
British West Indies	-	265
Netherlands West Indies	1,333	463
North America	3,209	2,033
Colombia	324	281
Venezuela	6,444	9,422
South America	6,768	9,703
Italy	-	415
Netherlands	121	-
Spain	419	-
Europe	540	415
Japan	-	91
Asia	-	91
Virgin Islands	3,991	5,322
U.S. Possessions	3,991	5,322
Grand total	14,508	17,564

TABLE 10-IMPORTS OF NUMBER 4 FUEL OIL BY COUNTRY OF ORIGIN AND SULFUR LEVEL IN 1970
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
CANADA	0.	0.	419.	49.	0.	468.
TRINIDAD	66.	409.	2878.	388.	98.	3839.
N.W.I.	128.	0.	1793.	1311.	2027.	5259.
NORTH AMERICA	194.	409.	5089.	1748.	2126.	9566.
VENEZUELA	35.	636.	4015.	2565.	6448.	13699.
SOUTH AMERICA	35.	636.	4015.	2565.	6448.	13699.
NETHERLANDS	0.	0.	135.	0.	118.	253.
SOVIET UNION	0.	97.	0.	0.	0.	97.
ITALY	121.	0.	768.	0.	114.	1002.
RUMANIA	13.	1034.	132.	0.	0.	1178.
EUROPE	134.	1130.	1034.	0.	232.	2530.
ALGERIA	127.	0.	0.	0.	0.	127.
AFRICA	127.	0.	0.	0.	0.	127.
VIRGIN IS.	0.	0.	479.	0.	0.	479.
US POSSESSIONS	0.	0.	479.	0.	0.	479.
GRAND TOTAL	490.	2175.	10617.	4314.	8806.	26401.

TABLE 10-IMPORTS OF NUMBER 4 FUEL OIL BY COUNTRY OF ORIGIN AND SULFUR LEVEL IN 1971
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
CANADA	0.	0.	149.	63.	0.	212.
BAHAMAS	0.	140.	35.	0.	0.	175.
TRINIDAD	1668.	572.	1471.	273.	0.	3983.
N.W.I.	1704.	161.	2198.	2037.	876.	6975.
NORTH AMERICA	3371.	873.	3853.	2373.	876.	11346.
VENEZUELA	1732.	2525.	4670.	163.	245.	9336.
SOUTH AMERICA	1732.	2525.	4670.	163.	245.	9336.
ENGLAND	0.	150.	0.	0.	0.	150.
SPAIN	0.	0.	210.	0.	0.	210.
ITALY	257.	555.	443.	134.	0.	1390.
RUMANIA	131.	1224.	256.	0.	0.	1611.
EUROPE	388.	1928.	910.	134.	0.	3361.
TUNISIA	100.	0.	0.	0.	0.	100.
LIBYA	0.	168.	0.	0.	0.	168.
NIGERIA	72.	0.	0.	0.	0.	72.
AFRICA	171.	168.	0.	0.	0.	339.
GRAND TOTAL	5663.	5494.	9433.	2670.	1121.	24381.

TABLE 11-IMPORTS OF RESIDUAL FUEL OIL BY COUNTRY OF ORIGIN AND SULFUR LEVEL IN 1968
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
CANADA	24.	0.	0.	401.	1583.	2009.
MEXICO	0.	0.	0.	0.	4828.	4828.
PANAMA	0.	0.	0.	0.	7.	7.
BAHAMAS	0.	0.	126.	0.	0.	126.
BRITISH W.I.	0.	0.	0.	1156.	0.	1156.
TRINIDAD	0.	346.	1238.	38242.	11268.	51095.
N.W.I.	0.	0.	4859.	15178.	76563.	96600.
NORTH AMERICA	24.	346.	6223.	54977.	94249.	155820.
COLOMBIA	0.	0.	154.	3385.	0.	3539.
VENEZUELA	58.	0.	702.	49586.	97349.	147695.
ARGENTINA	228.	3534.	387.	445.	0.	4595.
SOUTH AMERICA	286.	3534.	1243.	53416.	97349.	155829.
SWEDEN	0.	0.	0.	0.	82.	82.
ENGLAND	0.	122.	5994.	1482.	2171.	9770.
NETHERLANDS	0.	0.	3481.	0.	1346.	4827.
BELGIUM	0.	0.	501.	0.	1670.	2171.
FRANCE	0.	0.	1458.	0.	0.	1458.
WEST GERMANY	0.	0.	0.	0.	89.	89.
SPAIN	0.	4214.	1564.	124.	0.	5902.
ITALY	360.	3048.	13928.	430.	48.	17815.
RUMANIA	0.	92.	0.	0.	0.	92.
EUROPE	360.	7476.	26927.	2036.	5405.	42205.
SAUDI ARABIA	0.	0.	0.	0.	358.	358.
BAHRAIN	0.	0.	0.	0.	384.	384.
ASIA	0.	0.	0.	0.	742.	742.
AFRICA	0.	0.	110.	0.	0.	110.
ALGERIA	0.	106.	0.	0.	0.	106.

TABLE11 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
IVORY COAST	0.	0.	252.	0.	0.	252.
GABON	0.	0.	0.	103.	0.	103.
AFRICA	0.	106.	362.	103.	0.	571.
VIRGIN IS.	432.	3411.	5299.	5526.	3988.	18657.
US POSSESSIONS	432.	3411.	5299.	5526.	3988.	18657.
GRAND TOTAL	1103.	14874.	40054.	116058.	201734.	373824.

TABLE 11-IMPORTS OF RESIDUAL FUEL OIL BY COUNTRY OF ORIGIN AND SULFUR LEVEL IN 1969
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
CANADA	0.	0.	140.	1104.	2228.	3472.
MEXICO	0.	0.	0.	0.	4940.	4940.
HONDURAS	0.	0.	0.	0.	45.	45.
PANAMA	0.	0.	0.	0.	347.	347.
BAHAMAS	0.	0.	191.	0.	0.	191.
BRITISH W.I.	0.	0.	0.	0.	381.	381.
TRINIDAD	23.	70.	6872.	31468.	20453.	58886.
N.W.I.	0.	135.	15154.	12749.	80143.	108181.
NORTH AMERICA	23.	205.	22356.	45322.	108538.	176443.
COLOMBIA	0.	0.	0.	7372.	674.	8046.
VENEZUELA	0.	59.	5588.	45692.	118238.	169577.
ARGENTINA	143.	131.	110.	0.	0.	384.
SOUTH AMERICA	143.	191.	5697.	53064.	118912.	178007.
ENGLAND	0.	647.	5433.	0.	479.	6558.
NETHERLANDS	0.	111.	9689.	342.	1007.	11148.
BELGIUM	122.	339.	2068.	20.	640.	3189.
FRANCE	0.	70.	2589.	122.	0.	2781.
SOVIET UNION	481.	0.	152.	0.	0.	633.
SPAIN	257.	2036.	3465.	246.	140.	6144.
ITALY	349.	2999.	21268.	538.	0.	25153.
YUGOSLAVIA	656.	889.	0.	109.	0.	1654.
RUMANIA	157.	1202.	286.	0.	42.	1688.
EUROPE	2022.	8292.	44948.	1378.	2308.	58948.
SAUDI ARABIA	0.	0.	0.	0.	505.	505.
BAHRAIN	0.	0.	0.	0.	188.	188.
ASIA	0.	0.	0.	0.	693.	693.

TABLE11 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
ALGERIA	114.	0.	0.	0.	0.	114.
IVORY COAST	0.	0.	651.	172.	0.	823.
GABON	0.	0.	0.	103.	0.	103.
SOUTH AFRICA	0.	0.	126.	0.	0.	126.
AFRICA	114.	0.	777.	275.	0.	1165.
VIRGIN IS.	0.	554.	13194.	4485.	6409.	24642.
US POSSESSIONS	0.	554.	13194.	4485.	6409.	24642.
GRAND TOTAL	2301.	9242.	86972.	104523.	236859.	439898.

TABLE 11-IMPORTS OF RESIDUAL FUEL OIL BY COUNTRY OF ORIGIN AND SULFUR LEVEL IN 1970
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
CANADA	373.	0.	1332.	356.	3360.	5420.
MEXICO	0.	0.	0.	108.	5372.	5480.
GUATEMALA	0.	0.	0.	0.	136.	136.
HONDURAS	0.	0.	0.	0.	30.	30.
PANAMA	0.	0.	0.	36.	365.	400.
BAHAMAS	1460.	3028.	6069.	0.	280.	10837.
BRITISH W.I.	0.	0.	0.	137.	0.	137.
TRINIDAD	0.	223.	19948.	18473.	15984.	54628.
N.W.I.	433.	686.	23677.	7543.	90124.	122462.
NORTH AMERICA	2265.	3938.	51025.	26652.	115650.	199530.
COLOMBIA	0.	0.	0.	4382.	855.	5237.
VENEZUELA	2041.	1058.	26881.	46110.	118317.	194407.
BRAZIL	907.	0.	0.	0.	0.	907.
ARGENTINA	0.	0.	155.	0.	0.	155.
SOUTH AMERICA	2948.	1058.	27036.	50492.	119172.	200707.
ENGLAND	0.	184.	2932.	164.	316.	3596.
NETHERLANDS	2764.	0.	11359.	437.	1014.	15575.
BELGIUM	141.	0.	1752.	0.	0.	1893.
FRANCE	0.	109.	1229.	0.	0.	1338.
SOVIET UNION	408.	228.	0.	0.	204.	840.
SPAIN	0.	3692.	5052.	0.	0.	8744.
ITALY	2218.	10081.	15126.	0.	70.	27495.
RUMANIA	332.	884.	158.	0.	49.	1423.
EUROPE	5863.	15178.	37608.	601.	1653.	60904.
SAUDI ARABIA	0.	0.	0.	0.	757.	757.
BAHRAIN	0.	0.	0.	0.	202.	202.
ASIA	0.	0.	0.	0.	959.	959.

TABLE11 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
ALGERIA	248.	124.	0.	0.	0.	372.
IVORY COAST	0.	0.	209.	0.	0.	209.
NIGERIA	0.	628.	0.	0.	0.	628.
AFRICA	248.	751.	209.	0.	0.	1208.
VIRGIN IS.	0.	12405.	28443.	1195.	10355.	52397.
US POSSESSIONS	0.	12405.	28443.	1195.	10355.	52397.
GRAND TOTAL	11324.	33331.	144321.	78940.	247788.	515704.

TABLE 11-IMPORTS OF RESIDUAL FUEL OIL BY COUNTRY OF ORIGIN AND SULFUR LEVEL IN 1971
(1000 BARRELS)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
CANADA	243.	2293.	4354.	671.	4831.	12392.
MEXICO	0.	0.	0.	0.	1411.	1411.
PANAMA	0.	0.	0.	24.	283.	307.
BAHAMAS	8621.	7513.	26179.	2263.	2838.	47414.
BRITISH W.I.	0.	0.	142.	0.	0.	142.
TRINIDAD	633.	1276.	20621.	15835.	7757.	46123.
N.W.I.	4025.	2224.	23587.	13373.	59133.	102342.
NORTH AMERICA	13522.	13305.	74884.	32166.	76253.	210130.
COLOMBIA	0.	0.	0.	6182.	36.	6218.
VENEZUELA	6079.	9490.	45906.	37500.	92505.	191481.
BRAZIL	581.	180.	423.	0.	0.	1184.
ARGENTINA	0.	120.	0.	0.	0.	120.
SOUTH AMERICA	6660.	9790.	46329.	43682.	92541.	199002.
NORWAY	0.	0.	0.	201.	166.	366.
ENGLAND	0.	1418.	1351.	0.	422.	3190.
NETHERLANDS	0.	1176.	1214.	175.	4100.	6666.
BELGIUM	209.	855.	652.	0.	0.	1715.
FRANCE	173.	131.	1105.	0.	368.	1778.
SPAIN	0.	476.	3139.	0.	114.	3730.
ITALY	6156.	8195.	10519.	137.	436.	25443.
RUMANIA	0.	243.	0.	0.	0.	243.
EUROPE	6539.	12495.	17980.	512.	5607.	43132.
SAUDI ARABIA	0.	0.	0.	29.	276.	305.
BAHRAIN	0.	0.	0.	246.	306.	552.
INDONESIA	344.	0.	0.	0.	0.	344.
ASIA	344.	0.	0.	275.	582.	1201.

TABLE11 (CONTINUED)

	≤.30	.31-.50	.51-1.00	1.01-2.00	OVER 2.00	TOTAL
ALGERIA	601.	126.	143.	0.	0.	870.
LIBYA	0.	540.	913.	0.	0.	1453.
IVORY COAST	0.	136.	0.	0.	0.	136.
NIGERIA	368.	1112.	913.	0.	0.	2392.
GABON	0.	0.	111.	0.	0.	111.
AFRI[illegible]	969.	1914.	2080.	0.	0.	4962.
VIRGIN IS.	10634.	33157.	25334.	590.	7485.	77200.
GUAM	0.	0.	0.	0.	147.	147.
US POSSESSIONS	10634.	33157.	25334.	590.	7632.	77347.
GRAND TOTAL	38667.	70661.	166606.	77225.	182615.	535775.